

ADDENDUM TO

COMPARATIVE COST OF CALIFORNIA CENTRAL STATION ELECTRICITY GENERATION TECHNOLOGIES

PUBLICATION NUMBER 100-03-001SD

SOLAR PHOTOVOLTAICS APPENDIX R

Staff had originally decided to omit its analysis of central station solar photovoltaic technology as it deemed this option to not be viable in the current marketplace. The Energy Commission Renewables Committee has since directed staff to include PV technology in the cost of generation report. Appendix R represents staff's addendum to the report, *Comparative Cost of California Central Station Electricity Generation Technologies*, based on this directive. In conjunction with staff's effort to solicit public comment on this work, staff had posted this work on its website for your perusal and will discuss it at the first committee workshop for the *Integrated Electricity Policy Report* on February 26th, 2003.

**Table R-1
Plant Information**

Technology Type	Solar
Fuel	None
Owner/Investor	Merchant
Base Year	2002
Inservice Year	2003

**Table R-2
Plant Size**

Gross Capacity (MW)	50.0
Parasitic Load (MW)	0.0
Net Capacity (MW)	50.0
Derate Factor (%)	100.0
Firm Capacity (MW)	50.0
Transmission Losses (%)	5.0
Required AS/reserves (%)	0.0
Average Hourly Output Rate (%)	100.0
Effective Load Carry Capacity (MW)	48.0
Annual capacity degradation rate (%)	1.0

**Table R-3
Capital Costs**

Escalation in Capital Costs	0.0%
AFUDC Rate	10.8%
Cash Cost	100.0%

**Table R-4
Construction Costs by Year**

	Years Out from On-Line Date				
	0	-1	-2	-3	-4
Cost %/Year	100%	0%	0%	0%	0%
Carry Over	\$7,200	\$0	\$0	\$0	\$0

**Table R-5
Fuel Use**

Heat Rate (MMBtu/Kwh)	0
Fuel Consumption (MMBtu/hr)	0
Start up fuel use (MMBtu/start)	0
No. of annual starts	0
Annual Fuel Use (Mmbtu)	0

**Table R-6
Operational Information**

Availability/Year (%)	25
Availability/Year (hours)	2,190
Equipment Life (hours)	62,580
Equipment Life (years)	30
Overhaul Interval (hours)	2,190
Maintenance Outage (days)	4
Maintenance Outage Rate (%)	1.1
Forced Outage (hours/year)	8
Forced Outage Rate (%)	0.1
Hours per Year Operation (hours)	2,086
Capacity Factor (%)	23.8
Annual Net Energy (GWh)	104

**Table R-7
Renewable Tax Benefits**

Invest Tax Credit (%)	10
RETC Calculation (\$/kWh)	791
Production Incentive-Investor (¢/kWh)	0
REPI Tier II Proportion Paid (%)	10

**Table R-8
Operations & Maintenance Costs (Employees)**

Employees	Full Time Employees	Hours/Year	Compensation per Employee
Managers	1	1,800	\$80,000 per year
Plant Operators	1	1,800	\$30 per hour
Mechanics	2	1,800	\$30 per hour
Laborers	2	1,800	\$20 per hour
Support Staff	0	1,800	\$20 per hour

Table R-9
Operations & Maintenance Costs (Other)

Fixed O&M (\$/kW-Yr)	10.0
O&M Escalation (%)	0.5
Insurance (%)	1.5
Labor Escalation Cost (%)	0.5
Overhead Multiplier	1.6
Other Operating Costs	
Make-up water (\$)	
Reservoir management (\$)	
Plant Scheduling Costs	
Transmission Service (\$)	

Table R-10
Cost Summary

Financing Costs (\$/kW-yr)	954
Fixed Operational Costs (\$/kW-yr)	152
Tax (w/Credits) (\$/kW-yr)	(96)
Fixed Costs (\$/kW-yr)	1,010
Fuel Costs (\$/kW-yr)	0
Variable O&M (\$/kW-yr)	0
Variable Costs (\$/kW-yr)	0
Total Levelized Costs (\$/kW-yr)	1,010
Capital (\$/MWh)	484.21
Variable (\$/MWh)	0.00
Total Levelized Costs (\$/MWh)	484.21
Capital Costs	
Instant Cost (\$/kW)	7,200
Installed Cost (\$/kW)	7,752
In-service Cost in 2004 (\$/kW)	7,907

Table R-11
Capital Cost Detail

Total Capital Cost (\$)	360,000,000
Component Cost (\$)	350,000,000
PV Modules (\$)	225,000,000
Structures (\$)	25,000,000
Inverter (\$)	25,000,000
Installation (\$)	37,500,000
Project Management (\$)	37,500,000
Land Cost (\$)	10,000,000
Acreage/Plant	250
Cost per Acre (\$)	40000
Acquisition Cost (\$)	10,000,000
Land Preparation Costs (\$/acre)	0
Total Land Prep Costs (\$)	0
Permitting Costs (\$)	0
Local building permits (\$)	
Environmental permits (\$)	
Interconnection Costs (\$)	0
Transmission Lines (\$)	
Substation (\$)	
Induction Equipment (\$)	
Environmental Controls (\$)	0
Installation Costs (\$)	0
Replacement Costs (\$)	

Table R-12
Maintenance Cost Detail

Cost Category	Parameter	Cost (\$/year)
Routine Maintenance Costs		
Filter Replacement Interval (hours)	1	
Filter Price (\$/unit)	0.00	0.00
Oil Change Interval (hours)	1	
Oil Filter Price (\$/unit)	0.00	0.00
Oil Price (\$/gallon)	3.40	
Oil Capacity (gallons)	0	0.00
Oil Added (gallons/day)	0.00	0.00
Fuel Filter Interval (hours)	1,000	
Fuel Filter Price (\$/unit)	0.00	0.00
Labor (hours/day)	0.00	
Labor price (\$/hour)	48.00	0.00
Total Annual Routine Maintenance		0
Major Overhauls		
Time to Major Overhaul (hours)	31,290	
Major Overhaul Labor (man-hours)	1,250	
Labor Cost (\$/hour)	48.00	
Major Overhaul Labor Cost (\$)	60,000	
Major Overhaul Parts Cost (\$)	0	1,461.55
NPV Cost (\$)		
Minor Overhauls		
Annual Cost Item 1 (\$)	0	
Time to Item 1 Job (hours)	2,086	
Annual Cost Item 2 (\$)	0	
Time to Item 2 Job	0	
Annualized Overhauls		0
Unscheduled Maintenance		
Forced Outage (hours/year)	8	
Labor Rate (\$/hour)	48	
Labor Time per event (hours)	8	
Parts Costs (\$)	1,000	
Total Cost (\$)	1,384	
Total Annual Maintenance		2,846
Maintenance (\$/kW-yr)	0.06	
Maintenance (\$/MWh)	0.03	

Table R-13
Environmental Control Costs

Total Annual Costs (\$)	0
Air Emissions	
Control Technology (e.g., SCR)	
Installation Cost (\$/kW)	0
Annual Labor (hours/year)	0
Loaded Labor Rate (\$/hour)	48
Labor Cost (\$/year)	0
Annual Consumables (\$)	0
Replacement Cost (\$/kW)	0
Component Life (hours)	141,760
Annualized Cost (\$)	
Water Discharge	
Control Technology (e.g., wastewater)	
Installation Cost (\$/kW)	0
Annual Labor (hours/year)	0
Loaded Labor Rate (\$)	48
Labor Cost (\$)	0
Annual Consumables (\$)	0
Replacement Cost (\$/kW)	0
Component Life (hours)	141,760
Annualized Cost (\$)	
Solid Waste Disposal	
Non-hazardous Material	
Tons per Year	0
Collection and hauling (\$/ton)	10
Landfill tipping fees (\$/ton)	30
Total Costs (\$)	0
Hazardous Materials	
Tons per Year	0
Collection and hauling (\$/ton)	10
Landfill tipping fees (\$/ton)	30
Total Disposal Costs (\$)	0